

# **Intel Multi-Core Briefing**

**March 1, 2005**

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**Digital Enterprise Group**

# Agenda

- **Intel Platform Strategy**
- **Intel Multi-core Processor and Platform Plans**
- **Multi-core Benefits**
- **Intel Pentium Processor Extreme Edition**
- **Intel Enabling**
- **Summary**

# Intel Platform Strategy... and Multi-core

- Intel continues to drive platform strategies across segments
  - Driven by expanding end user needs
  - Platform advancements: Wireless, Manageability, Security, Form Factor, Battery life, Compute Capability,...
- Intel Multi-core platforms are means to deliver tremendous growth in compute capability
  - Builds upon the success of Hyper-Threading Technology
  - Multi-threaded application performance and Responsiveness in Multi-tasking environments

*Intel Multi-core: Enabled by Intel Innovation and Moore's Law*



# DEMO

## Intel® Pentium® Processor Extreme Edition

- Demo consists of a Pentium Processor Extreme Edition running the Cinebench 2003 benchmark, based on the Maxon\* Cinema 4D application. It shows an image rendering based on a single thread versus four threads, and then calculates the benefit. This shows that Intel's forthcoming platform running today's Windows\*XP operating system can provide performance improvement from one to four threads.

# The Move to IA Multi-core

Platform	Current	2005	2006+	Future	
Itanium® processor MP	Itanium® 2 Processor	Montecito	Montvale	Tukwila	
Itanium® processor DP	Itanium® 2 Processor - 3M (Fanwood)	Millington	DP Montvale	Dimona	
MP Server	Intel® Xeon™ Processor MP	64-bit Intel® Xeon™ processor MP	Paxville	Tulsa	Whitefield
DP Server / WS	64-bit Intel® Xeon™ Processor w/ 2MB cache		Dempsey	Future	
Desktop Client	Pentium® 4 processor	Pentium® Processor Extreme Edition	Presler	Future	
		Smithfield			
		Pentium® 4 processor	Cedar Mill		
Mobile Client	Pentium® M processor		Yonah	Future	
			Yonah		
		Single core	Dual/Multi-core		




All products and dates are preliminary and subject to change without notice.





# The Move to IA Multi-core

Platform	Current	2005	2006+	Future												
Itanium® processor MP	Itanium® 2 Processor	<div><div>&gt;10 Multi-Core Projects Spanning All Segments</div><table><thead><tr><th></th><th>2005</th><th>2006**</th></tr></thead><tbody><tr><td>Desktop*</td><td>Shipping</td><td>&gt;70%</td></tr><tr><td>Server</td><td>Shipping</td><td>&gt;85%</td></tr><tr><td>Mobile*</td><td>Shipping</td><td>&gt;70%</td></tr></tbody></table><p>* Mobile &amp; Desktop Pentium</p><p>** data is projected run rate exiting the year.</p><p>Source: Intel</p></div>				2005	2006**	Desktop*	Shipping	>70%	Server	Shipping	>85%	Mobile*	Shipping	>70%
	2005				2006**											
Desktop*	Shipping				>70%											
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Itanium® processor DP	Itanium® 2 Processor - 3M (Fanwood)															
MP Server	Intel® Xeon™ Processor MP															
DP Server / WS	64-bit Intel® Xeon™ Processor															
Desktop Client	Pentium® 4 processor															
Mobile Client	Pentium® M processor															



Single core

Dual/Multi-core



# The IA Multi-core Platforms

## Platform

## 2005

## 2006+

<b>Itanium® Processor Family</b>	<b>MP</b>	Montecito Intel® E8870 Chipset / Enabled	<b>Future</b>
	<b>DP</b>	Millington Intel® E8870 Chipset / Enabled	<b>Future</b>
<b>Intel® Xeon™ Processor MP Servers</b>			<b>Truland Platform</b> Paxville Intel® E8500 Chipset
<b>Intel® Xeon™ Processor DP Servers</b>			<b>Bensley Platform</b> Dempsey Blackford Chipset
<b>UP Server</b>		Pentium® D Processor Mukilteo Chipset	

<b>Desktop Client -Home</b>	<b>Anchor Creek Platform</b> Pentium® Processor Extreme Edition Pentium® D Processor (Smithfield), Presler Intel® 945/955X Express Chipsets
<b>Desktop Client -Office</b>	<b>Lyndon Platform</b> Pentium® D Processor (Smithfield), Presler Intel® 945/955X Express Chipsets

<b>Mobile Client</b>	<b>Napa Platform</b> Yonah Processor Calistoga Chipset Golan Wireless LAN
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All products and dates are preliminary and subject to change without notice.

Note: only multi-core processors listed



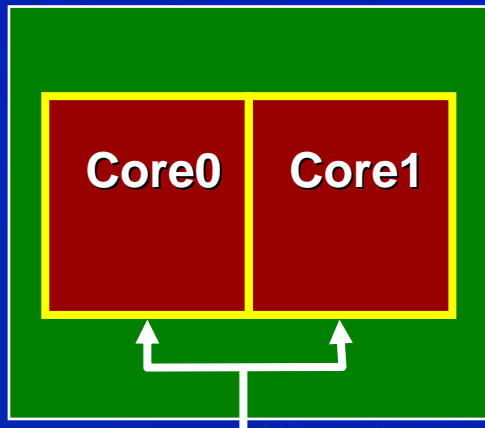


# What is Multi-Core?

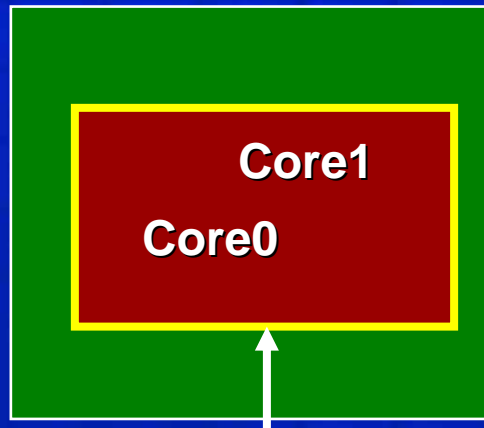
- Two or more independent execution cores in the same processor
- Specific implementations will vary over time - driven by manufacturing cost efficiencies
  - Best mix of product architecture and volume mfg capabilities
  - Designed to deliver performance, OEM and end user experience

## Single die (Monolithic) based processor

Example: Smithfield

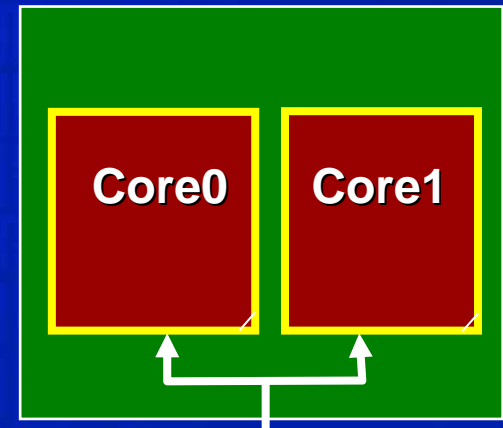


Example: Montecito



## Multi-Chip Processor

Example: 65nm "Presler"



Front Side Bus

Front Side Bus

Front Side Bus

**Server Consolidation**  
 Pentium® processor-based system

Databases  
 Enterprise Apps  
 RISC Replacement  
 Back

The diagram shows two blue server icons labeled 'VM' on the left and right. Between them is a central orange vertical bar representing an application stack, containing five labels: 'App A', 'App B', 'App C', 'App D', and 'App E'. Dashed arrows indicate data flow: from the left VM to each application, from each application to the right VM, and from the right VM to three 'OS' labels stacked vertically on its right side.

A diagram illustrating the concept of area. On the left, a blue square has four red arrows pointing outwards from its center towards the text "sq. ft.". On the right, there is a black rectangular frame containing a red background with a black curved line and three small black vertical tick marks, resembling a scale or a graph.

**Web Services, Spontaneous  
Event Driven**

**INDUSTRY STANDARDS**  
ITU, ETSI, IEEE, ANSI, ISO, IEC, JTC-1, ECMA, INCITS, OASIS, etc.



# Napa: Technology to Benefit the End User

## *Performance*

Yonah: 1<sup>st</sup> mobile 65nm DC,  
**Intel® Digital Media Boost**  
Calistoga: improved integrated  
graphics

## *Thinner Lighter*

Golan: MiniCard  
Small form factor GMCH  
**Intel® Advanced Thermal Manager**

## *Battery Life*

Intel Integrated Graphics  
EBL techniques  
**Intel® Dynamic Power  
Coordination**

## *Wireless*

Support latest IEEE 802.11  
standards  
Cisco\* Compatible Extensions

Runs multi-threaded, multiple intense applications, and  
background tasks with greater responsiveness, delivering a  
better on-the-go experience for the digital home & digital office



*\*New feature information – more details in Mobility Keynote & Briefings*

# Parallelism in the Digital Home

Enhanced User  
Experience\*  
'Enjoy'

## Multimedia

- Edit, create, share: music, videos, and photos

## Multi-Task

- Enjoy multimedia, gaming, IM, browsing, ..

...while

...While  
Transparently  
Running Multiple  
Background  
Applications



Protection:

Virus Scan

Firewall

Data backup

Data encryption



Platform

Health/Operation:

Automatic Downloads

OS Updates and

services

Compression

Content Management:

Transcode to different formats

Delivering multiple streams

Record content to the hard drive

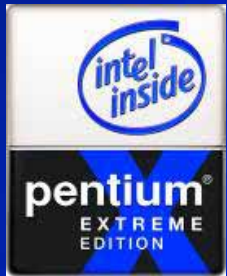
(PVR)



*\*Performance  
improvements relative to  
single threaded CPUs in  
similar market segment*



# Intel Desktop Dual Core Platforms



**Intel® Pentium® Processor Extreme Edition  
with Intel® 955X Express Chipset**



**Intel® Pentium® D Processor (Smithfield)  
with Intel® 945 Express Chipset Family**

***Coming in Q2 '05***

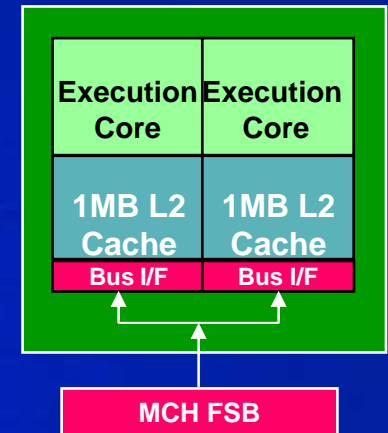


# Pentium® Processor Extreme Edition 840

## Intel Dual Core with Hyper-Threading Technology

### Summary:

- 3.2 GHz dual core processor
- 2MB L2 Cache (1MB each core)
- 800 MHz FSB
- Intel® EM64T
- Execute Disable Bit
- Built on 90 nm process technology
- LGA775 package
- Die size: approx. 206 mm<sup>2</sup>
- Transistor count: approx. 230M
- Introduction Q2'05



***Rich New Features Boosting Platform Experience***



# The Balanced Performance Platform

## Intel® 955X Express Chipset Family

**800/1066MHz FSB**

**PCI-E\* x16 Gfx  
Dual x16 with Bridge**

**6-PCI-E\* x1 Expansion<sup>1</sup>**

**Intel® High-Definition  
Audio**

**8-Hi-Speed USB2.0**

**2-Channel DDR2-667**

**Performance Memory  
Optimizations**

**8GB Memory Support**

**ECC Memory Support**

**4-SATA ports**

**Intel® Matrix Storage  
Technology (RAID  
0,1,5,10 and AHCI)<sup>1</sup>**

1 PATA port

PCI Ports

***Innovation for High End Performance & Advanced Usages***

# Performance for an Extreme Experience



**Don't delay your departure: Convert digital movies for content on the go**

*High Definition Video Encoding with Adobe\* Premiere\* using Microsoft\* Windows\* Media Encoder Advanced Profile*

**50%  
Faster<sup>1</sup>**



EXTREME EDITION



**Quickly enhance your music mix: Enjoy custom music with superior sound quality**

*MP3 encoding (Razor Lame\*) + Sound Normalization (MP3 Gain\*)*

**65%  
Faster<sup>1</sup>**



**Create digital content faster: Develop and render images with ease**

*Rendering 3D images with 3D Studio Max\**

**52%  
Faster<sup>1</sup>**



**Do more while gaming: Play a game while recording multiple TV shows**

*Gaming with Need for Speed 2\* and dual TV tuner using Snapstream\* PVR*

**124%  
More Frames<sup>1</sup>**

## Configurations and Disclaimers

**Source:** Intel® Configuration: Intel® Pentium® Processor Extreme Edition 840 (2x1MB L2 Cache, 3.20 GHz, 800 MHz FSB) – Intel® pre-production Lakeport Chipset, 1GB DDR2 667 (2x512MB); Intel® Pentium® 4 Processor with HT Technology Extreme Edition 3.73 GHz (2MB L2 Cache, 1066 MHz FSB)– Intel® i925XE Chipset, Intel D925XECV2 Desktop Board. **All Platforms** –Intel® Chipset Software Installation Utility 6.10.1002, Intel Application Accelerator RAID Edition 4.5 with RAID ready; Memory: 1GB DDR2 533 (2x512MB); ATI\* Radeon\* X800 XT Platinum Edition PCIe, ATI Catalyst 4.11 Driver Suite: Display driver version: 6.14.10.6490, Seagate ST3160023AS Serial ATA 160GB 7200RPM, DirectX 9.0c, Operating System : Windows XP Professional Build 2600 SP2 NTFS, *Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance.*



<sup>1</sup> When comparing a Intel® Pentium® Processor Extreme Edition 840 to an Intel Pentium 4 Processor with HT Technology Extreme Edition 3.73 GHz

# Intel: A Total Platform Approach





# Intel Threading Enabling

## Developer Platforms



HT/ Dual Core  
platforms  
Remote Access

## SW Tools and Expertise



Intel Compilers  
Intel Threading Toolkit,  
Performance Libraries,  
Whitepapers  
SW Engineers

## Extensive Support Services

Early Access Program

Threading Immersion  
Program

Application Tuning  
Centers

Intel Solution Services

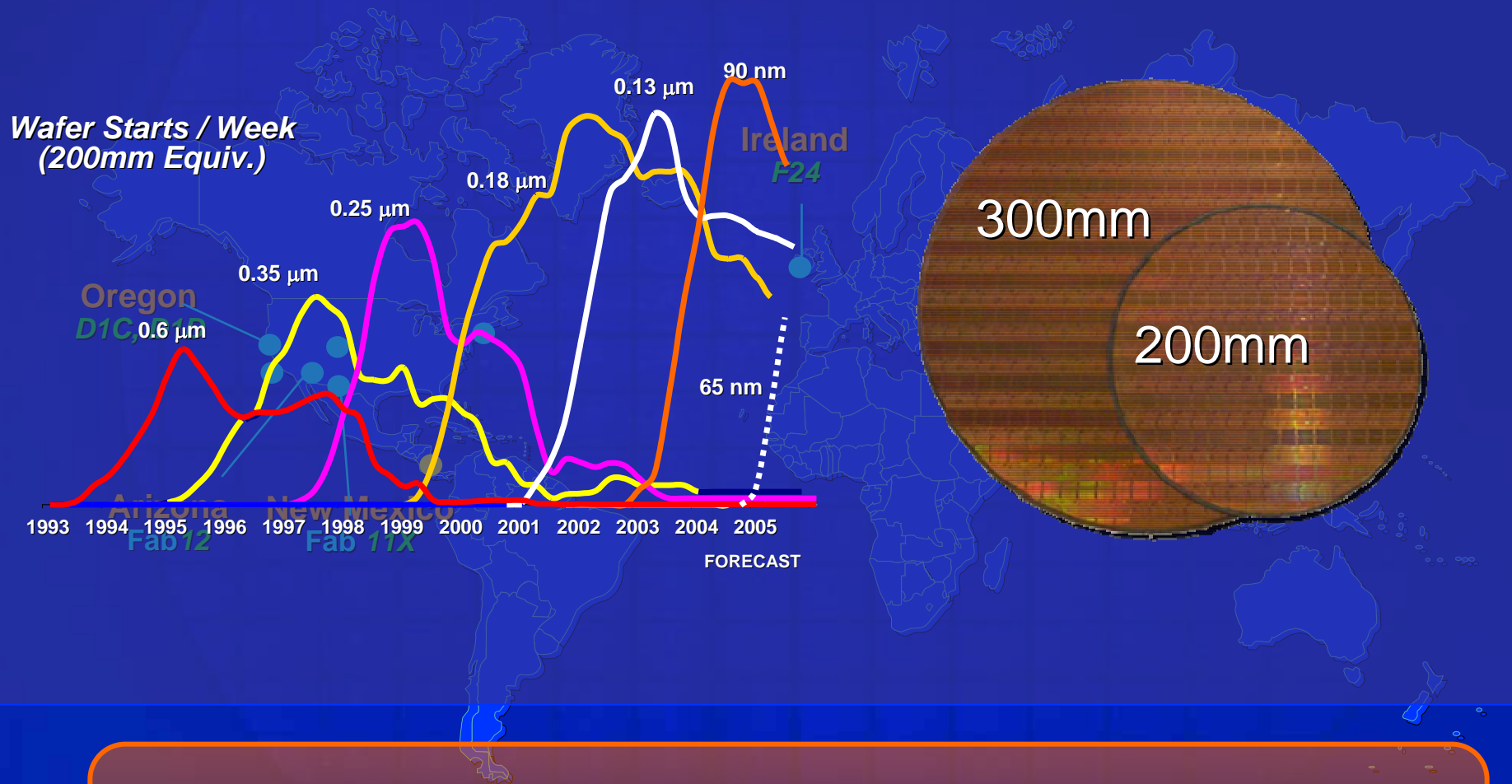
Intel Software College

***Comprehensive Enabling: Accelerating the Ecosystem***

# Threading: Intel Working With ISVs



# Intel 300mm Ramp Capability



Worldwide Manufacturing and Sales Channels

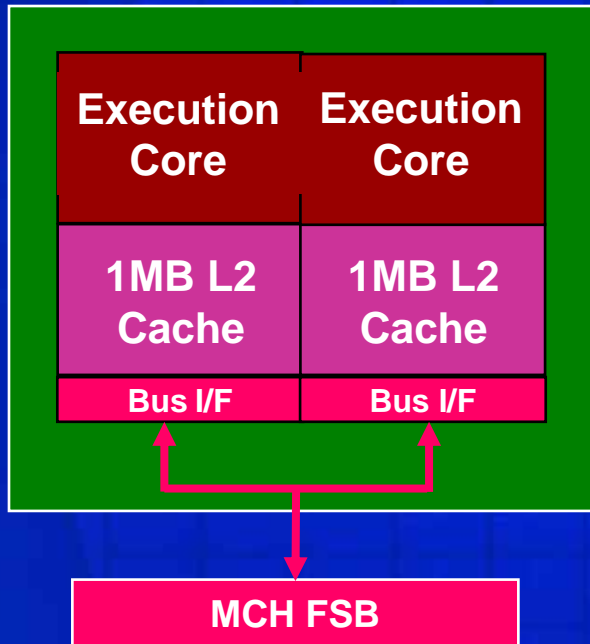


# Summary

- **Intel is addressing expanding end user needs with advancements to the platform**
  - Broad array of multi-core products
- **Intel Multi-core: Enabled by Intel Innovation and Moore's Law**
- **Intel accelerating value and deployment via a powerful enabling strategy**

# Reference

# Intel® Pentium® Processor Extreme Edition Overview

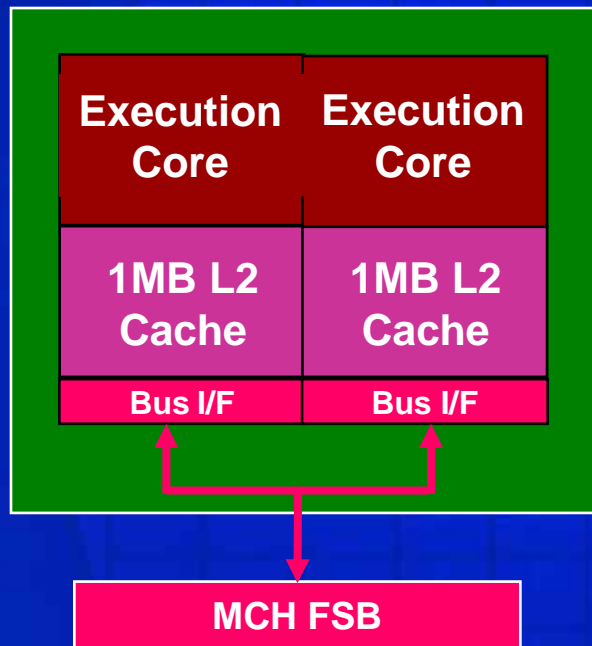


**Implementation:** *One* piece of silicon *two* execution cores

## Summary

Micro-architecture	NetBurst
Hyper-Threading Technology	Yes – Support for four threads
L2 Cache	2MB total (1MB per core)
FSB	800 MHz
Intel® EM64T	Yes
Execute Disable Bit	Yes
Socket	LGA 775
Process technology	90nm
Transistors	230M
Die Size	206 mm <sup>2</sup>
Chipset	Intel 955X Express Chipset
Availability Target	2Q'05

# Intel® Pentium® D Processor Overview (Smithfield)

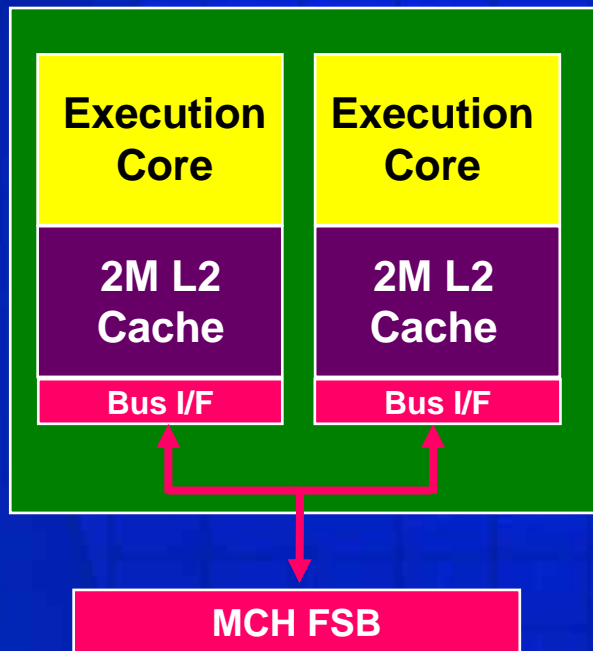


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Availability Target	2Q'05

# Presler Desktop Processor Overview

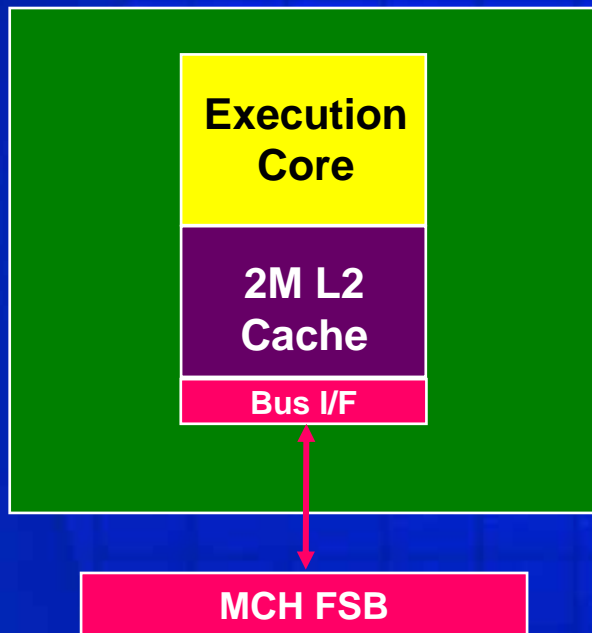


**Implementation:** *Two* pieces of silicon; **two** execution cores

## Summary

Process technology	65nm
Availability Target	1H'06
Intel® EM64T	Yes
Execute Disable Bit	Yes
Socket	LGA 775

# Cedar Mill Desktop Processor Overview



**Implementation:**  
*One* piece of silicon  
*one* execution core

Summary	
Process technology	65nm
Availability Target	1H'06
Intel® EM64T	Yes
Execute Disable Bit	Yes
Hyper-Threading Technology	Yes
Socket	LGA 775



# Yonah Processor Overview

Summary	
Mobile Optimized Micro-architecture	Yes
Process technology	65nm
Supporting Chipset	Calistoga
Wireless LAN	Golan
Availability Target	early '06

Implementation: *One*  
piece of silicon; *two*  
execution cores



## **Smithfield/Mukilteo Entry Server**

- **Ideal for small and value conscious organizations**
  - Dependable; easy to afford, deploy, and manage
- **Supports dual core Smithfield**
  - Powered to handle entry-level server applications
  - Expands on benefits enabled by existing Hyper-Threading Technology infrastructure
- **Optimized for entry level 1S server segment**
  - Intel's proven experience in delivering stable, compatible servers
  - Intel's 3rd generation chipset architecture
- **Platform longevity**
  - Latest technology including DDR2, PCI Express\*, serial ATA RAID, and 800Mhz FSB



**Introducing Dual-Core in '05...**  
**...Ramping Top-to-Bottom in '06**

## Smithfield/Glenwood Workstation Platform

- **Low-cost, high-performance, and leading graphics technology**
  - Suited for graphics design, high-end 3D graphics, and AEC applications
- **Supports dual core Smithfield XE/Smithfield**
  - Boost productivity output with workstation applications
  - Expands on benefits enabled by existing Hyper-Threading Technology infrastructure
  - XE with Hyper-Threading Technology provides more threads to increase threaded workstation application performance
- **Latest technology including PCI Express\* graphics, DDR2 ECC memory, and 64 bit extensions**



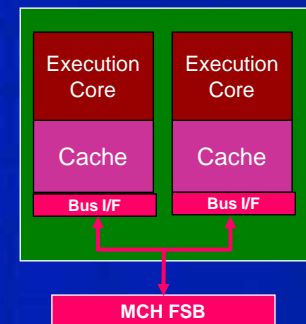
**Introducing Dual-Core in '05...**  
**...Ramping Top-to-Bottom in '06**

# Bensley & Glidewell Platforms

- The Bensley 2S server platform and the Glidewell 2S workstation platform are architected for dual-core processors. They are designed to address the needs of enterprise users through:
  - Compelling performance gains
  - Fully-Buffered DIMM memory technology
  - Intel® I/O Acceleration Technology
  - Improved power management over previous generation
  - Virtualization
  - Intel® Active Management Technology
- Product availability for the Bensley & Glidewell platforms is expected in 1Q 2006
- Key platform ingredients:
  - Dempsey processor
  - Blackford chipset for 2S volume servers; Greencreek chipset for 2S workstations; Blackford-VS chipset for 2S value servers
  - ESB2 Enterprise Southbridge & Gilgal Gigabit Ethernet PHY
  - Sunrise Lake I/O Processor



## Dempsey



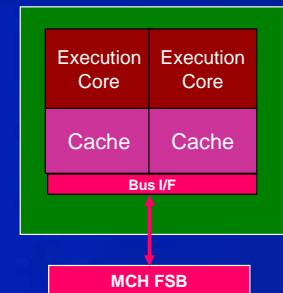
Dempsey Feature Summary	
Process technology	65nm
Intel® EM64T	Yes
Execute Disable Bit	Yes
Availability Target	Q1'06

# Truland Platform Overview

- The Truland 4S Platform is architected for dual-core processors to provide maximum scalability
  - Intel® Xeon™ processor MP + Intel® E8500 chipset
  - Platform introduction in Q1'05, dual-core support in Q1'06
- Key Platform ingredients:
  - Dual-independent front side buses
    - provides >3x the system bus bandwidth vs. today's MP platforms
  - Quad channel DDR2-400 memory support
    - providing headroom for dual-core processors
  - New platform RAS features:
    - Error-correcting system bus, memory RAID, PCI Express hot-plug I/O
  - Supports 1<sup>st</sup> MP Xeon dual-core cpu, codename: Paxville
  - 40-bit addressing
  - Demand Based Switching with Enhanced Intel SpeedStep® technology
  - XD bit



## Paxville



Paxville Feature Summary	
Process technology	90nm
Intel® EM64T	Yes
Execute Disable Bit	Yes
Availability Target	Q1'06



# Montecito platforms

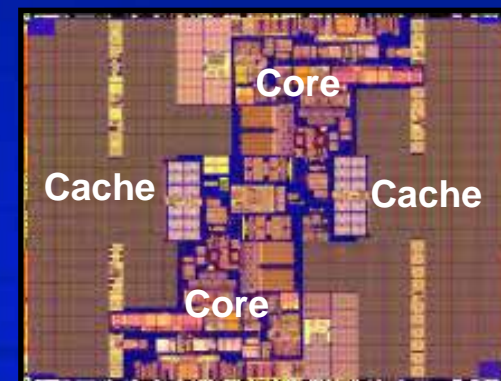
- **Montecito: Next Itanium® Processor Family product after Madison-9M**

- Dual core, multi-threading, 24MB cache
- Platform compatible with Itanium® 2 processor
- First 1.72 billion transistors processor
- Significant performance improvement with lower power
  - 1.5-2x over Madison-9M
  - 100W
- Demo'd last year, first samples in Sept'04
- OEMs currently testing Montecito platforms
- Montecito shipping in 2005

- **Montecito also brings new technologies**

- Foxton: Performance boost while maintaining power
- Vanderpool: Virtualization
- Pellston: Reliability
- Demand Based Switching: Server power savings

## Montecito



### Montecito Feature Summary

Process technology	90nm
Availability Target	Q4'05



# Future Itanium® Processor Family

- **Millington (based on Montecito)**
  - For dual processor and low voltage systems
  - Expected in 2005
- **Montvale**
  - Due after Montecito
  - Enhanced dual core processor
- **Tukwila**
  - Next generation after Montecito
  - Multi-core
- **Dimona (based on Tukwila)**
  - Follow-on to Millington

# Future Intel® Xeon™ processors

- **Tulsa**
  - Platform compatible with Intel® E8500 chipset
  - Follow on to Paxville
  - 65nm Technology
  - Dual-core processor
- **Whitefield**
  - Next generation multi-core Xeon MP processor
  - 65nm technology
  - Shares common platform architecture with Tukwila